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Turning data into experiences. Pro-active experiences and their significance for customers and business

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Abstract

In an era of connected devices an ever increasing amount of data can be observed. In most cases "Dumb Data". Most interfaces currently used react to actions taken in the present, without utilizing the data available to predict future needs, creating anticipatory experiences.Some companies, like Google (Nest, Google Now) or Amazon (anticipatory shipping) have recognized the value of anticipation early on, others are following suit.Pro-active applications are expected to contribute to a better user experience, but they also may cause the user to feel uncomfortable and monitored. Hence, answering the following questions is of paramount importance: Is it possible to create relevant anticipatory experiences without falling into the “uncanny valley” of anticipation?

*Keywords:*Anticipatory experiences; Predictive analytics;Uncanny valley; User experience;Big data;Wearable technology

1. Introduction

Almost all digital products (and products with digital components) are dealing with a huge amount of data. And even if "Big Data" is still a trending buzzword, in most cases it is still rather "Dumb Data" [1]. I call it "Dumb Data", as it still does not add much value for the customer. The majority of the systems and interfaces that we use and develop today are responsive. Not in the sense of Responsive Web Design, but in the semantic meaning of theword:they just respondproperly to actions and changes that take place in the present.

Mobiledevices are one of the driving forces behind the transition from responsive to anticipatory user experiences. The era of universal distribution of mobile phones started in the late 1990s[2] and from then until 2007 or 2008there weren’t any significant changes within the concept of mobile experiences[3]. Mobile phones were mainly used for phone calls or text messages and not much beyond that [4].

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The most notable innovation in this period could be labeled as the PDA-era. PDAs allowed the user to receive and send emails on the go and were also able to, although on a very basic level, provide access to websites. Following this slight change of the mobile context a new kind of devices managed to find their ways into the users' hands. Smartphones, in the beginning predominantly embodied as Apple's iPhone, started to increase in popularity and distribution. Even though the first iterations of smartphones left many things to be desired on the soft- and hardware-level, they marked a turning point in mobile-history.

One of the few things those early versions were already equipped with were sensors. And besides the mobile-factor, sensors are one of the main accelerators for the shift to anticipatory experiences. Additional factors are location-based-operations, the collection of data and social media [5]. Those components liftthe users' interaction with and expectation from technology from being purely responsive to a proactive or anticipatorytier of interaction.

2. From responsive to anticipatory

To dive deeper into the terminology used in this paper, the term "responsive" shall be further examined. Responsive web design found its peak by the year 2013 [6] and has been established as a standard of modern website creation by now. Analysing "responsive" on a semantic level may help to get a better grasp of the layers, in which responsive web design is applied. When something or someone is "responsive", it means that it responds to something, it is receptive to something. It is therefore passive, reactive rather than proactive. [7].

The majority of systems and interfaces, which are currently being used and developed, have rather limited proactive or anticipatory capabilities. They react to actions and changes that take place in the present – that is why they are responsive. Anticipatory interfaces however are capable of changing their behavior dynamically and provide a way of interaction with the user based on aspects and user preferences of the past and the present and of their expectations of future actions.

3. Hypothetical scenario

The possibilities in which proactive experiences can be involved in everyday life seem to be endless. Listing some of them by creating a small hypothetical futuristic scenario at this point of the paper will serve to get a bettergrip ofthe ideology and the premises behind anticipatory technologies and experiences and future user-technology relationships:

In the near future a typical daily routine could look like the following: It starts with the smart-mattress recognizing the user's sleep patterns to wake her up in an appropriate moment without disturbing the deep sleep phase. The mattress then sends information about the user's awakening to the blinders, which automatically roll up, and to the kitchen, where the coffee maker starts to brew coffee. Air conditioning, music, lightning – the whole apartment is connected, equipped with sensors and is not only gesture-controlled, but is also able to learn preferences and behavior and to adjust itself to them. The smart closet recommends suitable clothing tothe user, considering her appointments later that day and the weather forecast. The smart toilet is able to analyze her body data and based on those, dietary recommendations are passed on to the smart kitchen, where breakfast is being prepared based on this information and her preferences.During breakfast, the user is being provided with suggestions on which groceries to buy, including the cheapest merchant, by her smart fridge and just has to approve the order. The self-driving car synchronizes with the calendar and analyses the route and traffic to the first appointment. Forthe upcoming birthday of a relative, she receives gift recommendations based on the relative's recent social media activities and existing gift-history, where she is only left having to approve one of them. In the afternoon, the user stops by a fashion store and just after entering the store, she receives a friendly reminder from her personal finance management provider that her shopping budget is exceeded for this month and that it would be wise to re-visit the store in a month, because prizes are expected to drop.

This example of a not to distant future dayshould provide some insights intothe potential of anticipatory experiences.

4. Enabling anticipation

Anticipatory technologies find their first references in science fiction literature, inside the visual entertainment industry or in other hypothetical scenarios like above. What has been ideologically existent for several decades now, starts to find its way intomainstream consumer markets. This is related to the rapid increase of memory and processing capacity of modern computer technology. These impressive capabilities of modern computing power are demonstrated by today's examples ofIBM's,Watsonbeating human opponents in "Jeopardy", as well as the fact that todays smartphones have as much processing power asa supercomputer from the late 1990s [8].

Mobile, social, data, sensors and location, the five context-enabling forcesmentioned earlier, in tandemmark a groundbreaking changein theusers' perception of technology. Technology has made the transition from a productivity tool to a mobile, social and functional assistant in everyday life. Quoting Nicholas Negroponte: "Computing is not about computers anymore. It's about living." [9]

There has also been a drastic change in the usage of mobile phones in general. Making phone calls is currently only the 6th most popular activity involving a smartphone and 40% of the smartphone users state that they could live without it [10]. And there areeven more signs of transition in this sector. The term "mobile" does not just cover mobile phones or smart phones anymore. It now includes a variety of different wearable devices such as smart watches, glasses, fitness tracking devices etc. In the near predictable future this list will surely be extended with innovations like smart contact lenses or body-implanted health monitoring devices.

Innovations like this are closely related to sensor technology in smartphones and wearable devices. They are an essential part for measure and detection capabilities of those devices. Starting with accelerometers, gyroscopes, magnetometers for orientation, the proximity sensors, the light sensors and the thermometer and air humidity sensors over the pedometers, heart rate monitorsandfingerprint sensors.

A large amount of sensoric information would lack applicability without location data. Seemingly a basic function of modern mobile phones, it is as essential as it seems rudimental. Many mobile use cases involve location and even the idea of using an analogue map for orientation has vanished from the users mind by now.

Sensoric technology and location data are integrated within social media applications and enhance the highly personalized content generated by the user. This content enables technology to understand and contextualize the user's identity and herpreferences and to predict upcoming actions the user might take.

The data generated by all those components can be considered as one of the context-enabling forces of anticipatory interfaces. According to IBM's estimate, 90% of the world's data was generated in the past two years[11]. According to Jennifer Erwitt in The Human Face of Big Data "Now, in the first day of a baby's life today, the world creates 70 times the data contained in the entire Library of Congress"[12]. This huge amount of data is commonly subsumed under the buzzword "Big Data", whereas the small, highly personalized data is really the driver of context and anticipatory experiences.[13].

Daily life is not yet as penetrated through anticipatory technologies as described in the hypothetical future-scenario, but since the technological components are already widely available, it is only a matter of time and level of ubiquity for their arrival in our daily lives. For now, however, there is no common terminology for experiences generated by these components. Terms like "anticipatory computing", "anticipatory interfaces", "proactive experiences", "predictive technology" are among the most commonly used. "Right time experiences" [14] or "five forces of context"[15]are also possible terms. For the purposes of this paper the term "anticipatory experiences" will be used.

5. Examples of anticipatory experiences

Anticipatory experiences are a kind of User Experience Design, in which the devices or software the user interacts with, are actively "thinking along". They know what the user is doing in this very moment, and predict what he or she is going to do next without the user having to take action.

A User Experience in an anticipatory design should ideally be like an interaction with a close human companion or significant other, who knows the user well enough to complete her sentences and knowing the user's habits and preferences so thoroughly, that most tasks are being executed without any explicit request.

A well-known example for an anticipatory system is Google's "Nest". Nest manufactures intelligent thermostats, providing personalized energy plans based on the behavior of the residents, weather conditions and electricity prices. This way Nest devices are able to anticipate which temperature settings are needed under which circumstances[16].

Another exampleis Luna, a smart mattress cover, that can learn the users' regular bedtime and set the bed to a comfortable temperature. It also tracks the sleep quality and claims to combine this knowledge about the users' night with the information about her day and to use those insights to recommend what works best for her sleep. Luna's smart alarm can identify the correct moment in the sleep cycle to wake the user up in the moment of light sleep[17].

Google Now provides the user with information relevant for his individual actionsautomatically. Google Now learns the user's routines and behavior and matches them with the external conditions. Depending on the usual daily schedule and the current location of the user, Google Now can recognize the current location, the most probable next destination and provide personalized traffic information[18].

6. Privacy of anticipatory experiences

An additional example provides anticipatory shipping by Amazon. This anticipatory logistics-management-tool will be capable of identifying and shipping products the customer will include into her next order, before she has actually placed it. This prediction is made based on the preceding searches, shopping behavior and other factors. The chosen products are supposed towait at the shippers' hubs or on trucks until the actual order arrives to speed up delivery times[19]. For some, anticipatory experiences like this have reached a point, where they start to make them uncomfortable. Adjusting a service to a user's preferences and aid herwith information at the right time are convenient, but basically making a purchase without the user's consent could be considered a step too far and uncanny.

Even more substantial privacy concerns exist with regard to the recent development in the health insurance sector. More and more health insurance companies are gathering information about the users health and fitnessvia wearable devices. At first sight, offering better insurance rates to those who live a health-conscious lifestyle seems legitimate, but may also lead to controversial consequences as soon as health insurance companies start to deny insurances or cheaper rates to those, who are not willing to provide this kind of information to them.

7. Uncanny valley of anticipation

Even if these examplescan be seen as providing agreat user experience, they can make the user feel spied onand uncomfortable.This phenomenon can be described as an "uncanny valley of anticipation". The term "Uncanny Valley" originates from robotics studies [20]. It states that the acceptance of robots and avatars is dependent onthe degree of anthropomorphism. The positive correlation between appreciation of robotics and the similarity with human beings stops at one point, as the similarity crosses a certain line and gets uncannily close to actual human behavior.

The same principle can be applied to anticipatory software. Approaches like the onesfrom Amazon seem to be somewhere around the uncanny valley, as they give users the impression of knowing more about them then they actually wish to expose.

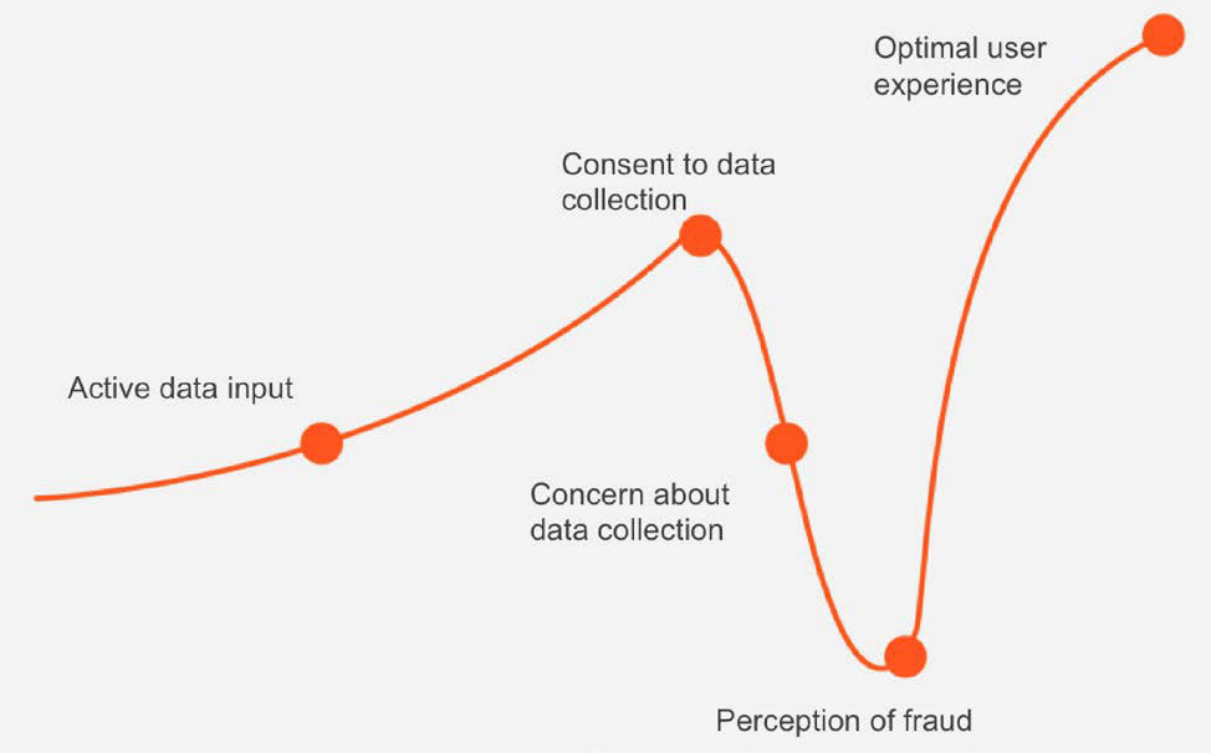

Fig. 1. Uncanny valley of anticipation.

8. Anticipation vs. control

Scenarios like those above and the concerns related to them might seem exaggerated, butthey are not too far off in the future already. Police forces in Germany started to use a system called “precob” to predict and prevent future burglaries[21]. Where does welcomed assistance by anticipatory technology end and where does a feeling of being patronized start? Will life in the near future, optimized based on preferences and habits, be easier and more comfortable or will it become too predictable and standardized to be enjoyable, as there is no space left for serendipity – or will each person’s individual preference for serendipity be even integrated into the algorithm? Reflections about this subject sometimes also involve the anxiety ofanticipatory becoming autonomous or even self-aware.

The need fordealing with these challenges in a more comprehensive manner will become unavoidable andthe concerns have to be addressed whendesigning anticipatory experiences. A checklist for the creation of obliging and convenient anticipatory user experience could look something like this:

- Relevance instead of uncanniness: Analyzing the user’s data helps to create better predictability, but taking it too farresults in feeling uncomfortable
- Assistance instead of patronization: Smart anticipatory user experience knows when to assist the user and when the user would like to make his own decisions
- Avoiding frustration for the user is key: Technology has to work properly at almost all times in order not to create frustration for the user

Anticipatory interfaces and technologies are still in their infancy. But the big technology companies are going to expand their proactive capacity even further. Their products and applications already posses most of the building

blocks necessary for anticipatory solutions. It is fair to assume, as many technology trend reports for 2015[22] and beyond do,the proliferation of anticipatory experiences in daily life.

References

[1] G.W. Boland, J.H Thrall, R. Duszak. Business Intelligence, Data Mining, and Future Trends, Reston, Virginia, 2015 pp. 9-11
[2] R. Ling. The mobile connection: the cell phone's impact on society, New York, 2008
[3] L. Hjorth. Studying mobile media : cultural technologies, mobile communication, and the iPhone, New York, 2012
[4] L. Hjorth, G. Goggin in G. Goggin, Mobile technologies : from telecommunications to media, New York, 2009, pp. 3-9
[5] R. Scoble, S. Israel. Age of Context: Mobile, Sensors, Data and the Future of Privacy, New York, 2013
[6] P.Cashmore(2012).Why 2013 Is the Year of Responsive Web Design, Mashable, Retrieved from http://mashable.com/2012/12/11/responsive-web-design
[7] proactive n.d. in The Free Dictionary online. Retrieved from http://thefreedictionary.com/proactive
[8] B. Clayton (2013, February 28) Mighty Mobile – There's a Supercomputer in Your Pocket. Retrieved fromdme.engin.umich.edu/mightymobile
[9] N. Negroponte. Being Digital, New York, 1995
[10] Hailo App Survey (2014, October 25) : Mobile Usage Survey
[11] IBM. (2013). What is big data? Retrieved from http://www-01.ibm.com/software/data/bigdata/what-is-big-data.html
[12] R. Smolan, J. Erwitt. The human face of big data. Sausalito, Calif, 2012
[13] O. Ferrer-Roca, R. Tous, R.Milito. in International Conference on Identification, Information and Knowledge in the Internet of Things, Beijing, 2014 pp. 260-261
[14] M. Lopez. Right-Time Experiences, Hoboken, New Jersey, 2014
[15] R. Scoble, S. Israel. Age of Context: Mobile, Sensors, Data and the Future of Privacy, New York, 2013
[16] Nest. http://nest.com
[17] Luna. http://lunasleep.com
[18] W. Gordon (2014, May 17): Lifehacker – Top 10 Awesome Features of Google Now. Retrieved from http://lifehacker.com/top-10-awesomefeatures-of-google-now-1577427243
[19] G. Bensinger (2014, January 17) WSJ – Amazon Wants to Ship Your Package Before You Buy It. Retrieved fromblogs.wsj.com/digits/2014/01/17/amazon-wants-to-ship-your-package-before-you-buy-it
[20] L.H. Liu. The Freudian robot : digital media and the future of the unconscious, Chicago, 2010
[21] AFP (2014, December 02) PHYS – Berlin police mull crime-predicting software. Retrieved from http://phys.org/news/2014-12-berlin-police-mull-crime-predicting-software.html
[22] D. Tennenhouse. Proactive Computing, Santa Clara, 2000